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UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Administration
Bureau of Plant Industry, Soils
and Agricultural Engineering

H. T. & S. Office Report No. 234

Ripening Pears in Transit in Fan Cars

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Report of a study carried out under the
Research and Marketing Act of 1946
Project No. 552

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March 1951
Beltsville, Maryland

Ripening Pears in Fan-Cars During Transit

Introduction

An initial test to study the feasibility of ripening western-grown winter pears while in transit between Chicago and New York was made in December, 1949 and reported in H. T. & S. Office Report No. 221. Because of the favorable results obtained it was considered desirable to conduct another test during the 1950 shipping season not only to check the previous season's work but to extend the heating period somewhat and to try out a standard type charcoal heater instead of using a thermostatically controlled heater. By using this type of heater, it was hoped to gain information on the type of equipment that is most likely to be used if such a service were inaugurated by the railroads.

Temperatures of 60° to 70°F. are desirable for ripening pears. Higher temperatures are conducive to poor quality in the ripened fruit and to early breakdown whereas lower temperatures retard the rate of ripening and may prevent development of maximum quality. In a study of ripening of winter pears (H.T.&S. Rpt. No. 212) it was found that pears ripened to a pressure test of 6 pounds were still firm enough for handling and would ripen to a good edible condition in 2 to 3 additional days. Ideal transit conditions for ripening therefore would be uniform temperatures throughout the load that do not go appreciably above 70° but that are high enough to ripen the fruit to approximately 6 pounds during the transit period. Ripening in transit would take the place of ripening in a ripening room at destination and would eliminate this extra handling. Because of variations in maturity when shipped, some cars heated in transit would arrive at destination with fruit not quite ripe enough for immediate distribution. These could be further ripened at trackside in terminal markets as described in H. T. & S. Rpt. 222, where pears were heated and ripened in fan cars after arrival at destination.

Methods and Procedure

Five cars of Bosc pears were loaded on November 22 at Medford, Oregon for shipment to New York. All fruit was packed out of cold storage where it had been held at 31°F. since harvest. Thirty test boxes of fruit were selected several weeks ahead of loading from one lot of fruit at one packing house and were composited before packing in order to have uniform fruit for each test car. Six boxes of this fruit were placed in each test car in the following positions: top, middle, and bottom quarterlength centerline, middle quarterlength north side, top doorway centerline and bottom doorway north side. The test boxes were removed at destination and placed in a 68° ripening room. Electric resistance thermometers were inserted in fruit in 10 positions and suspended in air in two positions in the head end of the cars. These positions and their designations were:

Top	quarterlength	centerline	- edge	TQCL - edge
"	"	"	- center	TQCL - center
Middle	"	"	- edge	MQCL - edge
"	"	"	- center	MQCL - center
Bottom	"	"	- edge	BQCL - edge
"	"	"	- center	BQCL - center
Middle	"	side wall	- edge	MQS - edge
"	"	"	- center	MQS - center
Bottom	doorway	side wall	- center	BDS - center
Top	"	centerline	- center	TDCL - center

Air - Top quarter centerline - 6" from ceiling - TQCL Air
Air - Bottom quarter centerline - under floor rack - BQCL Air

Positions noted as "edge" had the thermometer inserted into an outside pear at the edge of the box near the top, middle, or bottom of the box (boxes loaded on end) to correspond with the position of the box in the load. The "center" position was in a pear located in the 3rd layer from the top and in the center of the box in all cases. The thermometers for side wall positions were on the northside of the car from origin to Chicago but due to the cars becoming reversed in Chicago these positions were on the south side during the heating period. However, with the mild weather encountered it is not believed that there was much difference in temperature between the two sides of the cars between Chicago and Jersey City. Therefore, the position is referred to above and in the discussion as the "sidewall" position. Ryan thermographs were placed adjacent to the resistance thermometer used for obtaining air temperatures and one was mounted under one car to record outside air temperature en route.

The cars were of identical construction and contained 3 to 3-1/2" of insulation. They were equipped with Preco air circulating fans, 7-1/2" floor racks and wall flues. All loads were "through" loads and the boxes were placed on end 3 high, 8 rows wide and 32 stacks along the car. The cars were moved with vents closed and no heat or refrigeration was applied between Medford and Chicago. Fans were in the "ON" position for the entire trip between Medford and Jersey City.

The cars moved via S. P., U. P., C & NW., B. R. C. and Erie Railroads, and were unaccompanied to Chicago. Heaters were installed in the Proviso Yards of the C & NW. R.R. in Chicago and were lighted just before transfer to the Belt Railway. The test was accompanied by observers from Hammond, Indiana to Jersey City and temperature readings were made en route at regular train stops at intervals from 8 to 12 hours. The thermostats on the alcohol heaters were set at the maximum of 60° while the damper of the charcoal heaters was set at the wide open or full burning position. The test cars and heaters were as follows:

Car. No.	Type of Heater	Placement	Number Heaters
A PFE 5125	Preco thermostatic alcohol	1 each bunker	2
B PFE 3387	" " "	2 " "	4
C PFE 2353	Simplex standard charcoal	1 " "	2
D PFE 2063	" " "	2 " "	4
E PFE 7867	None -- Check car	---	0

Results

The weather encountered between Medford and Chicago was somewhat above normal for late November as indicated by the Ryan thermograph record of the outside temperature. (Fig. 1) Temperatures ranged from 26° to 75°F. except on the morning before arrival in Chicago when a low of 12°was reached. From Chicago to Jersey City the temperature varied from 17° to 38° which is about normal. During the period between arrival in Jersey City and unloading outside air temperatures rose to 50°. Total elapsed time between Hammond, Indiana and Jersey City, N. J. was about normal amounting to 41 hours and 5 minutes of which 27 hours and 30 minutes was running time. There were no long stops after departure from Hammond, the longest one being 2 hours and 55 minutes at Marion, hence the fans were in operation most of the time. The test shipment arrived at Jersey City at 6:15 a.m., Saturday, December 2, and the cars were unloaded at the auction on Pier 20 the next night. All loads were received in good order.

Heaters were lit at 2:00 a.m. November 30 at Proviso and extinguished and removed at 8:00 a.m. at Jersey City on December 2. The heating period was 53 hours as compared with 44 hours in the 1949 test. There was comparatively little movement of the cars during the first 10 hours after lighting the heaters or until the train left Hammond, Ind. Consequently the fans were not in operation much of this period. Heater operation was generally satisfactory, although there were two pilot failures on the alcohol heaters. The cause of this failure was not determined. In Car B with 4 alcohol heaters, the heaters in the head end were on pilot or partial burning after about 18 hours while those in the rear bunker were at reduced burning or on pilot after 28 hours. All heaters were on pilot after 36 hours indicating a bottom bunker air temperature of 60° or higher. In Car A with only 2 alcohol heaters, the heaters were on full burning for the entire period as bunker air temperatures never rose to the thermostat setting of 60°. The average fuel consumption in Car B was 3.9 gallons per heater and the total for the car was 15.65 gals. (see table 2). In Car A (see table 1) the average per heater was 4.95 gals. and the total for the car was 9.9 gals. The 4 charcoal heaters in Car D were set with the damper fully open and car temperatures rose so rapidly during the first 14 hours that the dampers on all four heaters were set to medium opening at Huntington, Ind. As the temperatures continued to rise, one heater in each end was darkened by closing the cut-off slide between the fuel magazine and the fire pot, and the dampers were shut to the "slow" position in the other two after they had been burning 28 hours. The two that were shut off at this point remained warm for several hours as they continued to burn until all fuel in the fire box was consumed. The two heaters in Car C remained at the full burning position for the entire 53 hours in transit (table 3). Fuel was added once en route. All heaters were removed from the cars at the end of the heating period. Fuel consumption in Car C was 52 lbs. or an average of 26 lbs. per heater or approximately 1/2 lb. per heater per hour. Total fuel consumed in Car D was 84 lbs. but because of the changes made in the burning rate en route no average figure can be given (table 4). Ten pounds of charkets were added en route to each of the two heaters that remained burning for the entire period.

The fruit temperatures averaged between 31° and 34° at loading and had risen to 42° by the time the cars reached Chicago. The averages of the 6 commodity temperatures at the quarterlength position for each car are shown in Fig. 2. In Cars A and C, with one heater in each end, the pears warmed slowly and steadily during the heating period (tables 5 & 7). The pears in Car C (charcoal heaters) reached 60° only about 18 hours before unloading or about 18 hours after the heating period terminated. The pears in Car A (2 alcohol heaters) were 52.6° average upon arrival at Jersey City and reached a maximum of only 55° at unloading time. The fruit in Car B (4 alcohol heaters) warmed more rapidly than in either A or C and reached an average of 60° just prior to arrival at Jersey City (table 6). Fruit temperatures in Car D (4 charcoal heaters) with all four heaters set at the maximum burning rate, rose rapidly and reached an average of 60° about 24 hours after the heaters were lit (table 8). After two of the heaters were darkened and the others set to slow burning the temperatures rose less rapidly and averaged 69.7° upon arrival at Jersey City. With the mild weather at Jersey City, the commodity temperature rose to 73.2° at time of unloading 36 hours later. The greater rise in temperature in cars with charcoal heaters was apparently due to a higher burning rate of these heaters at full draft as compared with the alcohol heaters. Due to the great amount of heat input in all four cars, there was considerable differential between top and bottom fruit temperatures. The car fans prevented it from being even greater. The difference between the maximum and minimum varied from 7 to 10 degrees when two heaters were used and between 10 to 20 degrees when 4 heaters were used. The check car temperatures remained practically constant at 41° throughout the test period and had a spread of only 2° because of air circulation from the fans (table 9).

Ripening of Pears in the Test Packages

Pressure tests made on the test pears at Medford at the time of shipment averaged between about 13 and 14 pounds. The data obtained from pressure tests made daily for five days on ten pear samples from each of the thirty test boxes while held after unloading in the ripening room at 68°F. and 90 percent relative humidity are shown in table No. 10. On arrival the pears in the bottom positions in each car were firmest, those in the top layers were softest and those in the middle layers were intermediate. These differences were particularly marked in Car B and reflect the temperature gradients in the cars. More uniform ripening would be desirable. They show that the fruit from the different positions in the car varied only slightly in pressure test but that there was considerable difference between cars with respect to the ripening behavior of the test pears. This can readily be seen by reference to figure No. 3, where the average pressure test readings for all boxes per car are plotted against the number of days in the ripening room.

The pears in Car E (check - no heaters) had a pressure test of 13.4 pounds at the time of unloading, thus indicating that they had not ripened in transit, and required nearly three days in the ripening room to soften them to between 6 and 7 pounds. It might be pointed out that Bosc pears, although edible when somewhat firmer are not generally considered to be fully ripe until they reach four pounds.

The pears in Car A (with two alcohol heaters) when unloaded likewise showed no evidence of having softened in transit and required 2 days in a ripening room to soften to 7 pounds. They remained in good condition for a total of about seven to eight days after unloading.

From a comparison of the two ripening curves the use of two alcohol heaters appears to have advanced ripening by about sixteen hours but not sufficiently to eliminate the need for additional conditioning.

The fruit in Car C (two charcoal heaters) had a pressure test of 11.7 pounds at the time of unloading, and that in Car B (four alcohol heaters) had a pressure test of 9.8 pounds. The fruit from both cars required about one day in the ripening room to soften to 7 lbs. On the seventh day after unloading the fruit from both cars was slightly overripe. The rate of ripening indicated by the ripening curves for cars E, C, and B (figure No. 3) indicate that the use of either two charcoal heaters or four alcohol heaters hastened ripening of the fruit by nearly two days but that one additional day was desirable to bring them to good marketable condition.

The pears in Car D (four charcoal heaters) softened during transit from an initial pressure test of 13-14 pounds to 5 pounds at the time of unloading. This is somewhat softer than has been suggested as desirable for removal from a ripening room. By the fourth day in the ripening room they were beginning to show slight evidence of breakdown. The use of four charcoal heaters advanced ripening by about three days or better and under these warm weather conditions caused slightly more ripening than desirable.

Commercial Loads

The fruit in the commercial loads of the cars was not comparable since different brands with different growing and picking histories were represented. A limited number of pressure tests made at the time of loading at Medford and again at Proviso indicated, however, that the pears in all cars were of about 12 to 14 pounds pressure.

Comparisons were made of all commercial carlots at New York while they were on display at the sales pier. The pears in Car E (check car) were the least ripe and showed some greenish color. They appeared to have changed little in firmness or color during the transit period. Those in Cars A (2 alcohol heaters) and C (2 charcoal heaters) were well colored, but apparently had not softened much, if any, during transit from Chicago. The pears in Car B (4 alcohol heaters) had softened somewhat, although they showed some greenish color. Those in Car D (4 charcoal heaters) were definitely the ripest of the five carlots. They were, in fact, fully colored and had softened to nearly good eating condition. Some concern arose as to whether they were too soft for wholesale trade.

The pears were sold on a weak market. The average price per box received for the test carlots was as follows: Car A - \$3.95, B - \$3.84, C - \$3.87, D - \$3.88 and E - \$3.76. There was no evident relationship between ripening in transit and price.

Discussion and Commercial Application of Results

The results of the test are clear-cut and furnish considerable information on what temperatures may be expected and the amount of ripening that may result from the use of two or four alcohol or charcoal heaters per car during transit. The comparative ripening behavior of the test fruit from the several cars closely parallels the transit temperature records. The use of four charcoal heaters per car appears to be unnecessary. The use of two alcohol heaters per car had very limited effect, as judged either by the raising of commodity temperatures or by the ripening of the pears. Under the conditions of the present test the use of either two charcoal heaters at full draft or four alcohol heaters at 60° thermostat setting per car brought about approximately the right degree of ripening of the pears in fan cars - with somewhat more rapid ripening when four alcohol heaters were used.

A number of factors must be taken into consideration in applying the results of the present tests to commercial practice. Thus, for example, hard pears ordinarily respond more slowly, and conversely less firm pears need less heat to hasten ripening. The length of the transit period and the promptness with which the cars are unloaded has a decided bearing on the use of transit heating to promote early ripening. Thus, more heat should be applied to loads destined for early unloading after relatively short runs than to loads destined for markets farther from the point at which heaters are installed. Weather conditions will also be a factor in heater operation. Under conditions of extreme cold it may be necessary to burn 4 charcoal heaters in a car for the first 18 to 24 hours and remove two after this period. Particular attention should be called to the fact that commodity temperatures were highest in all four cars during the period of about 36 hours extending from the time the heaters were extinguished and removed at Jersey City, and the time the cars were unloaded at New York City. Thus, once favorable ripening temperatures have been attained in a car, ripening may continue for many hours even though the heaters are removed if the outside temperature is as high (40-50°) as it was during this test. The temperature to which the load is heated will of course influence the rate of ripening. Although

ripening proceeds most rapidly at about 65° to 70°F., a temperature as low as 55°F. will promote ripening to a considerable extent. From a practical standpoint it is assumed that all cars in any particular shipment would be handled alike insofar as the heater installation and operation is concerned. As the amount of heat applied should be governed by most mature fruit, some cars will arrive at destination too hard and green for immediate distribution. These cars could be held at trackside with fan motors attached and operating until proper ripeness is reached. As previously stated, ripening to the proper degree in the car would eliminate the extra handling necessary when fruit is moved in and out of a ripening room.

From an over-all viewpoint it would appear that in any commercial application of this method for ripening in transit the commodity temperature should range between about 55° and 60° - 65°F. and should be maintained in the carload for forty-eight hours (or more) in order to bring the pears to the right degree of ripeness for immediate marketing.

Acknowledgements

This test was made possible through the cooperation and assistance of the following.

R. A. Patterson, General Manager, Oregon-Washington-California Pear Bureau for the general arrangements for the test and J. W. Dugan of the Bureau for assistance as a member of the test party from Chicago to New York.

Southern Oregon Sales, Inc., Reter Fruit Co., Pinnacle Orchard and Packing Co., and American Fruit Growers for furnishing the loads in Medford.

American National Co-Operative Exchange, Inc., Hearty & Loos, C. E. Merrill Company, and Sullivan, Wood and Company for their cooperation at unloading in New York.

Preco Inc., and Western Metal Specialties Co. for furnishing the heaters.

The Southern Pacific Railroad and Pacific Fruit Express Co. for providing the test cars and special handling at origin. J. F. Kohout and Al May of the Chicago and Northwestern Railroad for assistance and facilities in installing the heaters at Proviso, Illinois. The Erie Railroad for accommodations for the test party from Chicago to Jersey City and special handling of the test cars.

Edwin Smith, T. R. Wright, and M. Uota, U.S.D.A., Wenatchee, Washington for preparation of test boxes and cars and loading at Medford; M. A. Smith and G. B. Ramsey, U.S.D.A. Chicago for arrangements and assistance in installing heaters; B. A. Friedman and H. W. Hruschka, U.S.D.A., New York for assistance in unloading.

W. H. Redit, W. A. Radspinner, and J. W. Dugan accompanied the test cars from Chicago to New York.

Table No. 1

HEATER INSPECTION DATA

Test Car No. A Thermostat Setting 60° Heater Preco
Car No. PFE 5125 Fans On Drains Open Placement 1 each end

Inspected at	Date	Time	OST °F.	Bot. (1) Air Temp.	Burner Operation		Fuel added gals.		Fuel in heater gals.	
					H	R	H	R	H	R
Proviso	11/30	2:00A	24°		Lit				5	5
Hammond	"	11:00A	32°	41.0	B	B			4	4
Huntington	"	3:30P	34°	44.0	B	B			3.5	3.5
Marion	"	8:00P	22°	44.5	B	B			3	3.1
Meadville	12/1	6:30A	25°	46.5	B	B			2.1	2.1
Salamanca	"	3:00P	30°	47.0	B	B			1.5	1.5
Hornell	"	6:30P	28°	48.0	B	B	1.0	1.0	2.25	2.15
Jersey City	12/2	8:00A	32°	50.5	B	B	---	---	1.1	1.0
					Total Fuel Consumed				4.9	5.0
							Car Total			9.9gals.

Note - (1) Air temperature under floor racks at quarterlength - rear end

B - Full burning

Table No. 2

HEATER INSPECTION DATA

Test Car No. B
Car No. PFE 3387

Thermostat Setting 60°
Fans On Drains Open

Heater Preco
Placement 2 each end

Inspected at	Date	Time	OST °F.	Bot. Air Temp. (1)		Burner Operation		Fuel added	Fuel in heater	
						H	R		H	R
									Gals.	Gals.
Proviso	11/30	2:00A	24°			Lit			5	5
									5	5
Hammond	11/30	11:00	32°	48.5	Rt.	B	B		4	4
					Lft.	B	B		4	4
Huntington	11/30	3:30P	34°	52.5	Rt.	B	B		3.6	3.6
					Lft.	B	B		3.6	3.6
Marion	11/30	7:30P	22°	54.0	Rt.	P	B		3.25	3.25
					Lft.	PB	B		3.25	3.25
Meadville	12/1	6:30A	25°	57.0	Rt.	P	PB	None	2.75	2.5
					Lft.	PB	PB		2.5	2.5
Salamanca	"	3:00P	30°	56.5	Rt.	D-B(2)	PB		2.5	2
					Lft.	P	PB		2.0	2.0
Hornell	"	6:30P	28°	57.5	Rt.	P	P		2.3	1.75
					Lft.	D-B(2)	P		1.75	1.9
Jersey City	12/2	8:00A	32°	60.0	Rt.	P	P		2.1	0.5
					Lft.	P	P		1.25	0.5

Total Fuel Consumed	Rt.	2.9	4.5
	Lft.	3.75	4.5
Each End		6.65	9.0
Car Total			15.65 gals.

(1) Air temperature under floor racks at quarterlength - rear end
(2) Heater out - relit - went on full burning
B - Full Burning
P - Pilot
PB- Partial full burning
D - Dark

Table No. 3

HEATER INSPECTION DATA

Test Car No. C
Car No. PFE 2353

Thermostat Setting ---
Fans On Drains Open

Heater Simplex
Placement 1 each end

Inspected at	Date	Time	OST °F.	Bot. Air Temp.(1)	Heater Operation		Fuel added		Fuel in heater		Remarks
					H	R	H	R	H	R	
							lbs.	lbs.	lbs.	lbs.	
Proviso	11/30	2:00A	24°	----	Lit		----		20	20	Damper open wide
Hammond	11/30	11:00A	32°	43.0	B	B	----		----		" " "
Huntington	11/30	3:30P	34°	46.5	B	B	----		----		" " "
Marion	11/30	8:00P	22°	47.5	B	B	----		----		" " "
Meadville	12/1	6:30A	25°	50.5	B	B	10	15	5	5	" " "
Salamanca	12/1	3:00P	30°	51.0	B	B	----		-----		" " "
Jersey City	12/1	8:00A	32°	57.0	B	B	----		5	8	" " "

Heaters Removed

Total fuel 25 27

Car total 52 lbs.

Note - (1) Air temperature under floor racks at quarterlength - rear end

B - Burning

Table No. 4

HEATER INSPECTION DATA

Test Car No. D
Car No. PFE 2063

Thermostat Setting
Fans On Drains Open

Heater Simplex
Placement 2 each end

Inspected at	Date	Time	OST °F.	Bot. Air Temp.(1)		Heater Operation		Fuel added		Fuel in heater		Remarks
						H	R	H	R	H	R	
								lbs.	lbs.	lbs.	lbs.	
Proviso	11/30	2:00A	24°	----		Lit				20	20	Damper open wide
										20	20	
Hammond	11/30	11:00A	32°	50.0	Rt.	B	B			--------		
					Lft.	B	B					
Huntington	11/30	3:30P	34°	56.0	Rt.	B	B					Hd-to medium-R-same (change)
					Lft.	B	B					Hd-#4 opening R-#3
Marion	11/30	8:00P	22°	57.0	Rt.	B	B					H & R at medium
					Lft.	B	B					changed to medium
Meadville	12/1	6:30A	25°	61.5	Rt.	B	B	10	10	5	5	Changed to slow
					Lft.	B	B					Darkened-slide in
Salamanca	12/1	3:00P	30°	62.0	Rt.	B	B					Low burning
					Lft.	D	D					Head end-still warm Rear end-out cold
Jersey City	12/2	8:00A		65.5	Rt.	B	B	--		3	8	Low
					Lft.	D	D			5	0	

Heaters Removed

		H	R
Total fuel	Rt.	27	22
	Lft.	15	20
Each end		42	42
Car Total			84 lbs.

Note - (1) Air temperature under floor racks at quarterlength - rear end
B - Burning
D - Dark

Table No. 5

Corrected Air and Commodity Temperatures

Car No. **A (PFE 5125)**
2 Preco Alcohol Heaters

Commodity **Bosc Pears**

Station	Date	Time	OST °F.	Air BQCL	Air TQCL	BQCL Cen.	BQCL Edge	BDS Cen.	MQCL Cen.	MQCL Edge	MQS Cen.	MQS Edge	TQCL Cen.	TQCL Edge	TDCL Cen.	Max.	Min.	Ave. Quarter length CL	Ave. Car
	Nov.																		
Medford	22					Loaded Medford, Ore. Nov. 22 1:45–4:45 p.m.													
Medford	22	4:45P	41°	33.0	43.0	32.5	34.0	35.5	37.0	35.0	33.5	36.0	34.0	38.0	33.5	38.0	32.5	35.1	34.9
Proviso	29	10P	24°	39.5	40.5	40.5	40.5	43.0	39.5	41.5	41.0	40.5	42.0	42.5	40.5	43.0	39.5	41.1	41.2
Proviso	30	2A	24°			Heaters Installed & Lit													
Hammond	30	10:30A	32°	41.0	56.5	40.0	41.0	42.0	46.0	44.0	41.5	44.5	47.0	47.0	41.0	47.0	40.0	44.2	43.4
Huntington	30	3:30P	34°	44.0	52.0	41.0	43.0	42.5	47.0	46.0	43.0	47.5	46.5	48.0	42.5	48.0	41.0	45.3	44.7
Marion	30	CST	22°	44.5	53.5	42.0	44.0	43.0	47.0	46.0	43.5	47.5	47.5	49.0	43.0	49.0	42.0	45.9	45.3
	Dec.	7:30P																	
Meadville	1	6:30A	25°	46.5	57.0	44.0	46.0	45.5	49.5	48.0	46.0	49.5	48.5	51.0	45.5	51.0	44.0	47.8	47.4
Salamanca	1	2:30P	30°	47.0	65.5	45.5	47.0	46.5	51.5	49.0	48.0	51.5	49.5	53.5	47.5	53.5	45.5	49.3	49.0
Hornell	1	6:30P	28°	48.0	62.5	46.5	48.0	47.5	52.0	50.5	48.5	52.0	50.5	53.5	48.5	53.5	46.5	50.2	49.8
Susquehanna	1	11P	17°	51.0	57.0	48.5	50.0	49.5	53.5	51.5	50.5	53.0	51.5	55.0	50.5	55.0	48.5	51.7	51.4
Jersey City	2	7A	32°	50.5	68.0	49.5	51.0	51.0	55.0	53.0	51.5	53.5	53.5	56.5	51.5	56.5	49.5	53.1	52.6
Jersey City	2	8A				Heaters extinguished and removed													
Jersey City	2	4:30P	42°	47.0	56.0	51.0	50.5	52.0	56.5	52.5	52.5	53.0	55.0	57.0	53.0	57.0	50.5	53.8	53.3
New York	3	10:30A	46°	47.5	54.0	51.5	49.5	53.0	58.0	53.5	54.0	53.5	58.0	57.5	55.0	58.0	49.5	54.7	54.4
New York	3	6P	50°	49.0	55.0	54.0	50.5	53.5	58.5	54.0	54.5	54.0	58.5	57.5	55.5	58.5	50.5	55.5	55.1
New York	3					Unloaded 8 - 10 P.M.													

Table No. 6

Corrected Air and Commodity Temperatures

Commodity **Bosc Pears**

Car No. B (PFE 3387)
4 Preco Alcohol Heaters

Station	Date 1950 Nov.	Time	OST °F.	Air BQCL	Air TQCL	BQCL Cen.	BQCL Edge	BDS Cen.	MQCL Cen.	MQCL Edge	MQS Cen.	MQS Edge	TQCL Cen.	TQCL Edge	TDCL Cen.	Max.	Min.	Ave. Quarter length CL	Ave. Car
Medford	22			Loaded 8:30 - 10:10 A.M.															
Medford	22	4PM	41°	32.5	38.5	34.5	33.5	34.5	34.0	34.5	34.0	34.5	35.0	36.5	35.0	36.5	33.5	34.7	34.6
Proviso	29	10P	24°	39.5	42.0	42.5	41.5	42.0	42.0	41.5	42.0	41.0	42.0	43.5	42.5	43.5	41.0	42.2	42.1
Proviso	30	2A	24°	Heaters installed and lit															
Hammond	30	10:30A	32°	48.5	70.0	42.5	45.0	42.5	43.0	49.5	43.0	48.5	45.5	62.0	44.0	62.0	42.5	47.9	46.6
Huntington	30	3:30P	34°	52.5	65.0	43.5	49.0	44.0	44.5	53.0	44.5	51.0	49.0	63.5	46.0	63.5	43.5	50.4	48.8
Marion	30	CST	22°	54.0	69.5	45.0	51.0	46.0	46.0	54.0	46.5	52.5	51.5	65.5	48.0	65.5	45.0	52.2	50.6
	Dec.	7:30P																	
Meadville	1	6:30A	25°	57.0	74.5	49.0	54.5	50.0	50.0	56.0	50.0	55.0	56.5	63.5	52.5	63.5	49.0	54.9	53.7
Salamanca	1	2:30P	30°	56.5	71.5	52.0	55.5	52.5	53.5	57.5	52.5	57.0	59.5	68.0	56.0	68.0	52.0	57.7	56.4
Hornell	1	6:30P	28°	57.5	69.5	53.5	56.5	53.5	55.0	58.5	54.0	58.0	61.0	65.5	57.5	65.5	53.5	58.3	57.3
Susquehanna	1	11P	17°	60.5	69.0	55.0	58.5	55.0	56.5	61.0	55.5	59.5	62.0	66.5	59.0	66.5	55.0	59.9	58.9
Jersey City	2	7A	32°	60.0	73.0	59.0	61.0	58.0	60.5	63.0	58.5	61.0	64.5	69.0	62.0	69.0	58.0	62.8	61.7
Jersey City	2	8A		Heaters extinguished and removed															
Jersey City	2	4:30P	42°	54.5	63.5	61.0	58.5	59.5	62.5	62.5	60.5	60.0	66.0	68.5	64.0	68.5	59.5	63.2	62.3
New York	3	10:30A	46°	54.5	63.5	62.0	57.5	60.0	64.0	63.0	62.5	60.0	67.5	69.5	66.0	69.5	57.5	63.9	63.2
New York	3	6P	50°	56.0	65.0	62.5	58.5	61.0	65.0	63.5	63.5	61.5	68.0	67.5	66.5	68.0	58.5	64.2	63.8
New York	3			Unloaded 8 - 10 P.M.															

Table No. 7

Corrected Air and Commodity Temperatures

Commodity Bosc Pears

Car C (PFE 2353)
2 Simplex Charcoal Heaters

Station	Date	Time	OST	Air BQCL	Air TQCL	BQCL Cen.	BQCL Edge	BDS Cen.	MQCL Cen.	MQCL Edge	MQS Cen.	MQS Edge	TQCL Cen.	TQCL Edge	TDCL Cen.	Max.	Min.	Ave. Quarter length CL	Ave. Car
	Nov.																		
Medford	22						Loaded 8:00 A.M. - 3:30 P.M.												
Medford	22	3:30P	41°	31.5	40.5	31.0	31.0	32.0	30.5	31.5	31.0	34.0	31.5	35.0	31.5	35.0	30.5	31.8	31.9
Proviso	29	10P	22°	41.0	42.0	42.0	42.0	44.0	42.5	42.0	42.0	42.0	42.0	42.5	42.0	44.0	42.0	42.2	42.3
Proviso	30	2A	24°				Heaters Installed & Lit												
Hammond	30	10:30A	32°	43.0	62.0	42.0	42.5	43.0	42.5	47.0	43.5	48.5	44.0	51.5	43.5	51.5	42.0	44.9	44.8
Huntington	30	3:30P	34°	46.5	58.5	44.0	45.5	44.0	44.5	50.5	44.5	50.0	47.0	52.5	45.0	52.5	44.0	47.3	46.8
Marion	30	CST 7:30P	22°	47.5	62.5	45.5	47.0	45.5	46.0	52.0	46.0	51.5	49.0	53.5	46.5	53.5	45.5	48.8	48.3
Meadville	Dec.1	EST 6:30A	25°	50.5	67.5	49.0	50.5	48.5	49.5	55.0	48.5	54.5	52.5	56.5	50.5	56.5	48.5	52.2	51.5
Salamanca	1	2:30P	30°	51.0	77.0	50.5	51.5	50.0	51.5	55.5	51.0	56.0	54.5	60.0	53.0	60.0	50.0	53.9	53.4
Hornell	1	6:30P	28°	52.5	75.5	51.5	52.5	51.0	53.0	57.0	52.0	58.0	56.0	62.0	54.0	62.0	51.0	55.3	54.7
Susquehanna	1	11P	17°	55.5	66.5	53.5	55.0	53.5	54.5	59.5	54.0	59.0	57.5	61.5	56.0	61.5	53.5	56.9	56.4
Jersey City	2	7A	32°	57.0	77.5	57.0	57.5	56.0	57.5	61.5	56.5	61.0	61.0	64.0	58.5	64.0	56.0	59.8	59.1
Jersey City	2	8A					Heaters Extinguished and Removed												
Jersey City	2	4:30P	42°	53.5	63.5	58.0	56.5	57.5	59.5	60.5	58.0	59.5	62.5	64.5	61.0	64.5	56.5	60.3	59.8
New York	3	10:30A	46°	54.0	62.0	59.0	55.5	58.5	61.5	60.5	59.5	59.5	64.0	64.0	63.0	64.0	55.5	60.8	60.5
New York	3	6P	50°	55.0	63.5	59.0	56.5	59.5	62.0	61.5	61.0	60.0	65.0	64.5	64.5	65.0	56.5	61.4	61.4
New York	3						Unloaded 8 - 10 P.M.												

Table No. 8

Corrected Air and Commodity Temperatures

Commodity Bosc Pears

Car No. D (PFE 2063)
4 Simplex Charcoal Heaters

Station	Date Nov.	Time	OST	Air BQCL	Air TQCL	BQCL Cen.	BQCL Edge	BDS Cen.	MQCL Cen.	MQCL Edge	MQS Cen.	MQS Edge	TQCL Cen.	TQCL Edge	TDCL Cen.	Max.	Min.	Ave. Quarter length CL	Ave. Car
Medford	22						Loaded 9:15 A.M - 12:15 P.M.												
Medford	22	4P	41°	34.0	39.5	34.0	35.5	34.0	34.5	35.5	36.5	35.5	34.5	37.5	35.0	37.5	34.0	35.3	35.3
Proviso	29	10P	24°	42.5	42.5	43.0	45.5	45.0	44.5	44.0	--1/	43.0	44.5	47.0	44.5	47.0	43.0	44.8	44.6
Proviso	30	2A	24°				Heaters Installed & Lit												
Hammond	30	10:30A	32°	50.0	85.0	45.0	48.5	45.0	46.5	53.5	--	51.5	48.0	68.0	49.5	68.0	45.0	51.6	51.3
Huntington	30	3:30P	34°	56.0	77.5	47.0	53.5	48.5	51.0	59.5	--	62.0	52.5	68.0	54.0	68.0	47.0	55.3	55.1
Marion	30	CST	22°	57.0	82.5	49.0	55.5	51.5	53.5	61.0	--	64.0	55.0	69.0	57.0	69.0	49.0	57.2	57.3
	Dec.	7:30P																	
Meadville	1	6:30A	25°	61.5	85.5	55.0	61.5	54.0	60.0	67.5	--	69.5	63.0	74.5	64.5	74.5	54.0	63.6	63.5
Meadville	1	6:30A	25°				One Heater Each Bunker Darkened												
Salamanca	1	2:30P	30°	62.0	81.5	59.0	63.0	63.0	64.0	68.0	--	69.0	67.5	74.5	68.5	74.5	59.0	66.0	66.3
Hornell	1	6:30P	28°	62.5	77.5	61.5	64.0	65.0	65.0	68.5	--	68.5	69.0	73.0	69.5	73.0	61.5	66.8	67.1
Susquehanna	1	11P	17°	65.0	71.5	63.5	66.0	63.5	67.0	69.5	--	68.5	70.0	72.0	71.0	72.0	63.5	68.0	67.9
Jersey City	2	7A	32°	65.5	78.5	67.0	68.0	66.0	69.0	70.5	--	69.5	71.5	73.5	72.0	73.5	66.0	69.9	69.7
Jersey City	2	8A					Remaining Heaters Extinguished and Removed												
Jersey City	2	4:30P	42°	60.5	71.0	68.5	65.5	68.5	71.0	70.5	--	69.5	73.5	75.0	74.0	75.0	65.5	70.7	70.7
New York	3	10:30A	46°	61.0	72.0	70.0	65.0	--	73.5	71.5	--	69.5	76.0	76.0	76.5	76.5	65.0	72.0	72.3
New York	3	6P	50°	62.0	73.5	71.0	66.0	--	74.5	72.0	--	71.0	77.0	76.5	77.5	77.5	66.0	72.8	73.2
New York	3						Unloaded 8 - 10 P.M.												

1/ Thermometer out of order.

Table No. 9

Corrected Air and Commodity Temperatures

Commodity Bosc Pears

Car No. E (PFE 7867)
Check - No Heaters

Station	Date Nov.	Time	OST	Air BQCL	Air TQCL	BQCL Cen.	BQCL Edge	BDS Cen.	MQCL Cen.	MQCL Edge	MQS Cen.	MQS Edge	TQCL Cen.	TQCL Edge	TDCL Cen.	Max.	Min.	Ave. Quarter length CL	Ave. Car
Medford	22							Loaded 9:15 A.M. - 2:50 P.M.											
Medford	22	3:00P	42°	34.5	41.5	32.0	32.0	32.0	31.0	31.5	31.5	33.5	33.0	37.0	32.5	37.0	31.0	32.8	32.6
Proviso	29	10P	24°	40.5	41.0	41.5	41.5	42.5	41.5	40.0	41.5	41.0	41.5	43.0	42.0	43.0	40.0	41.5	41.6
Hammond	29	10:30A	32°	39.5	38.5	41.5	40.0	41.5	41.0	40.0	41.5	39.5	41.0	40.0	42.0	42.0	39.5	40.6	40.8
Huntington	29	3:30P	34°	41.0	41.0	41.5	40.5	41.0	41.5	40.0	41.0	40.5	41.0	41.0	42.0	42.0	40.0	40.9	41.0
Marion	29	7:30P	22°	41.0	40.5	41.5	41.0	41.0	41.0	40.0	41.0	40.5	41.0	41.5	41.5	41.5	40.0	41.0	41.0
Meadville	Dec.1	6:30A	25°	40.5	39.5	41.5	41.0	41.0	41.0	39.5	41.0	40.5	41.0	40.5	42.0	42.0	39.5	40.8	40.9
Salamanca	1	2:30P	30°	39.5	39.5	41.5	40.5	41.0	41.0	40.0	41.0	40.0	41.0	40.5	41.5	41.5	40.0	40.8	40.8
Hornell	1	6:30P	28°	39.5	39.5	42.0	41.0	41.0	41.0	40.0	41.0	40.0	41.0	40.5	41.5	42.0	40.0	40.9	40.9
Susquehanna	1	11P	17°	41.5	41.0	41.5	41.0	41.5	41.5	40.5	41.5	41.0	41.5	41.5	42.0	42.0	40.5	41.3	41.4
Jersey City	2	7A	32°	40.0	39.5	41.5	41.5	41.5	41.5	40.0	41.0	40.5	41.0	41.0	41.5	41.5	40.0	41.1	41.1
Jersey City	2	4:30P	42°	40.0	41.5	42.0	40.5	41.5	41.5	40.5	41.5	41.0	41.5	41.5	42.0	42.0	40.5	41.3	41.4
New York	3	10:30A	46°	40.5	41.0	42.0	41.0	43.5	41.5	41.0	41.5	41.5	41.5	42.0	42.5	43.5	41.0	41.5	41.8
New York	3	6P	50°	42.0	44.0	42.5	42.0	42.5	42.5	42.0	42.5	42.5	42.5	43.0	43.0	43.0	42.0	42.4	42.5
New York	3							Unloaded 8 - 10 P.M.											

Table 10. Pressure tests on pears during a four-day ripening period at 68° F.

			Pressure Test (pounds)			
			Days After Unloading			
[1] Car	[2] Location in Car	[3] Day of Unloading	1	2	3	4
A	BQCL	14.2	11.9	8.7	5.4	3.9
	MQCL	13.1	12.2	6.6	4.5	3.6
	TQCL	13.1	10.2	6.2	4.5	3.5
	MQS	14.4	11.7	7.1	5.1	3.3
	BDS	14.0	11.6	7.0	4.6	4.0
	TDCL	13.7	10.8	5.7	4.5	3.9
	Avg.	13.8	11.4	6.9	4.8	3.7
B	BQCL	12.0	7.7	4.5	4.3	3.4
	MQCL	9.7	6.8	4.9	3.8	3.2
	TQCL	7.1	5.2	3.8	3.7	3.3
	MQS	11.0	6.1	5.3	3.7	3.3
	BDS	11.7	6.9	4.5	3.8	3.4
	TDCL	7.1	5.1	4.0	3.2	3.4
	Avg.	9.8	6.3	4.5	3.8	3.3
C	BQCL	12.5	9.5	4.7	4.1	3.4
	MQCL	11.4	6.8	4.4	3.7	3.2
	TQCL	11.3	5.1	3.8	3.6	3.1
	MQS	11.9	7.2	4.8	3.7	3.0
	BDS	12.8	8.8	5.2	3.8	3.6
	TDCL	10.4	5.3	4.0	3.6	3.1
	Avg.	11.7	7.1	4.5	3.8	3.2
D	BQCL	6.1	4.4	3.9	3.6	3.3
	MQCL	5.0	3.2	3.4	3.1	3.0
	TQCL	4.4	3.8	3.2	3.1	3.0
	MQS	5.0	4.5	3.5	3.3	3.2
	BDS	6.1	4.3	3.6	3.2	3.0
	TDCL	3.5	3.4	3.3	3.1	3.1
	Avg.	5.0	3.9	3.5	3.2	3.1
E	BQCL	13.9	13.5	9.5	6.2	4.4
	MQCL	13.5	13.2	10.5	5.5	4.3
	TQCL	12.9	12.9	9.0	6.5	3.9
	MQS	13.1	12.7	9.4	6.7	4.4
	BDS	13.6	12.5	9.2	5.1	4.0
	TDCL	13.1	12.1	8.4	4.8	3.8
	Avg.	13.4	12.8	9.3	5.8	4.1

[1] A = Two alcohol heaters; B = four alcohol heaters; C = two charcoal heaters; D = four charcoal heaters; E = check car - no heaters.

[2] BQCL = Bottom quarterlength centerline; MQCL = middle quarterlength centerline; TQCL= top quarterlength centerline; MQS = middle quarterlength side; BDS = bottom doorway side; TDCL = top doorway centerline.

[3] First pressure tests made during the forenoon following the night of unloading. Subsequent tests made at daily intervals thereafter.

FIGURE No. 1

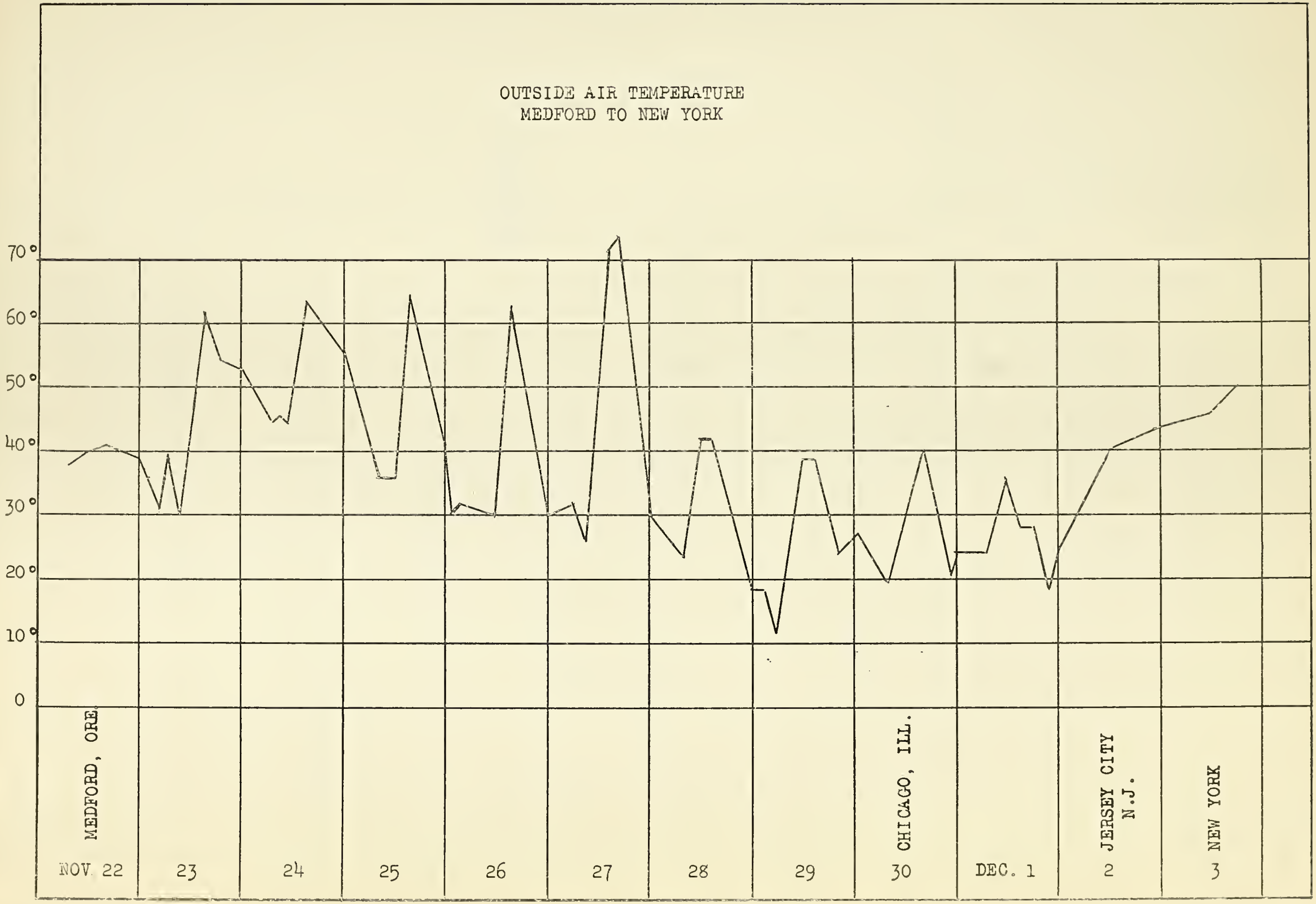

OUTSIDE AIR TEMPERATURE
MEDFORD TO NEW YORK
70°
60°
50°
40°
30°
20°
10°
0
MEDFORD, ORE.
CHICAGO, ILL.
JERSEY CITY N.J.
NEW YORK
NOV. 22
23
24
25
26
27
28
29
30
DEC. 1
2
3

FIGURE 2

AVERAGE COMMODITY TEMPERATURE DURING
TRANSIT HEATING PERIOD FOR EACH TEST CAR

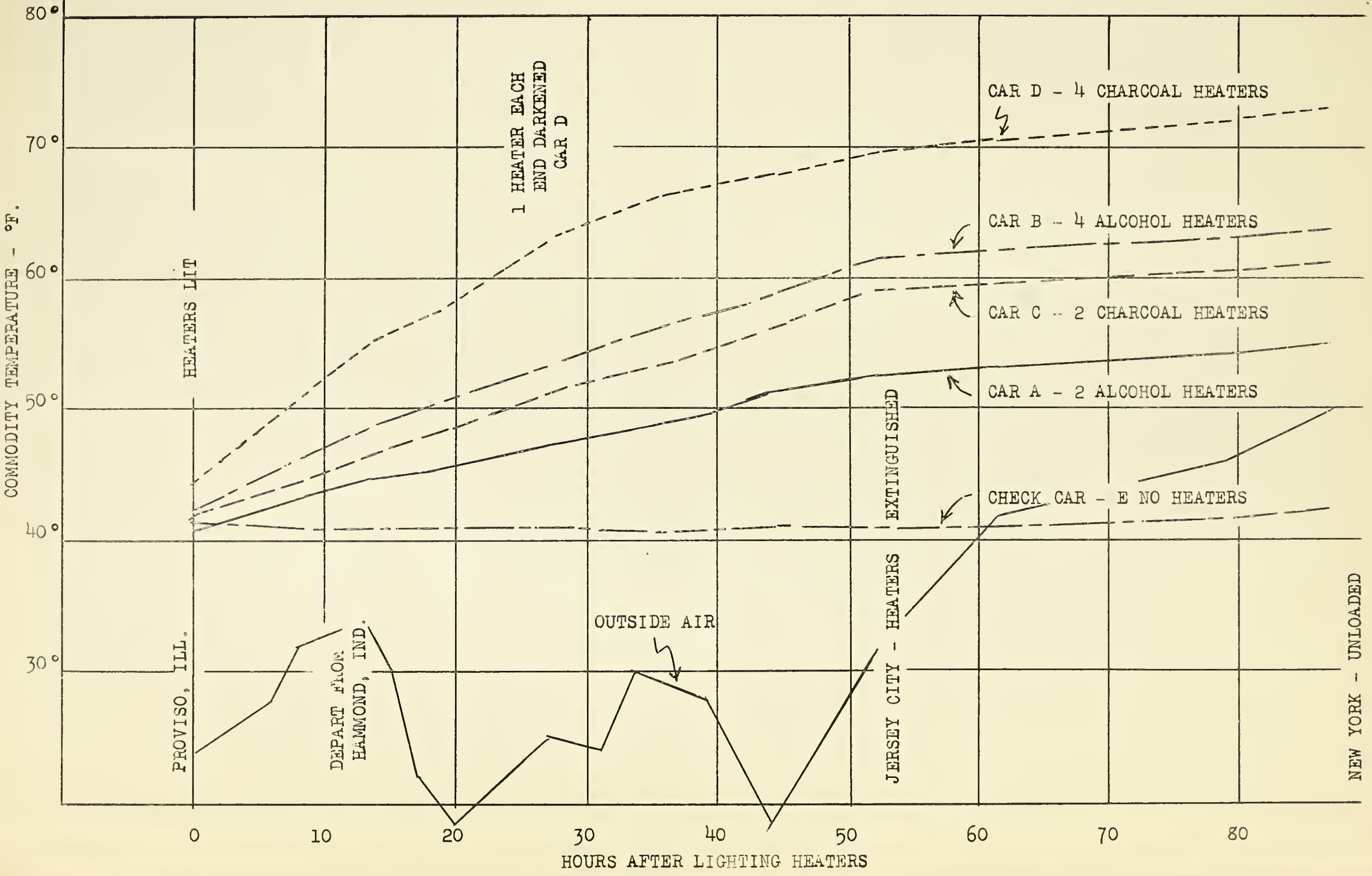
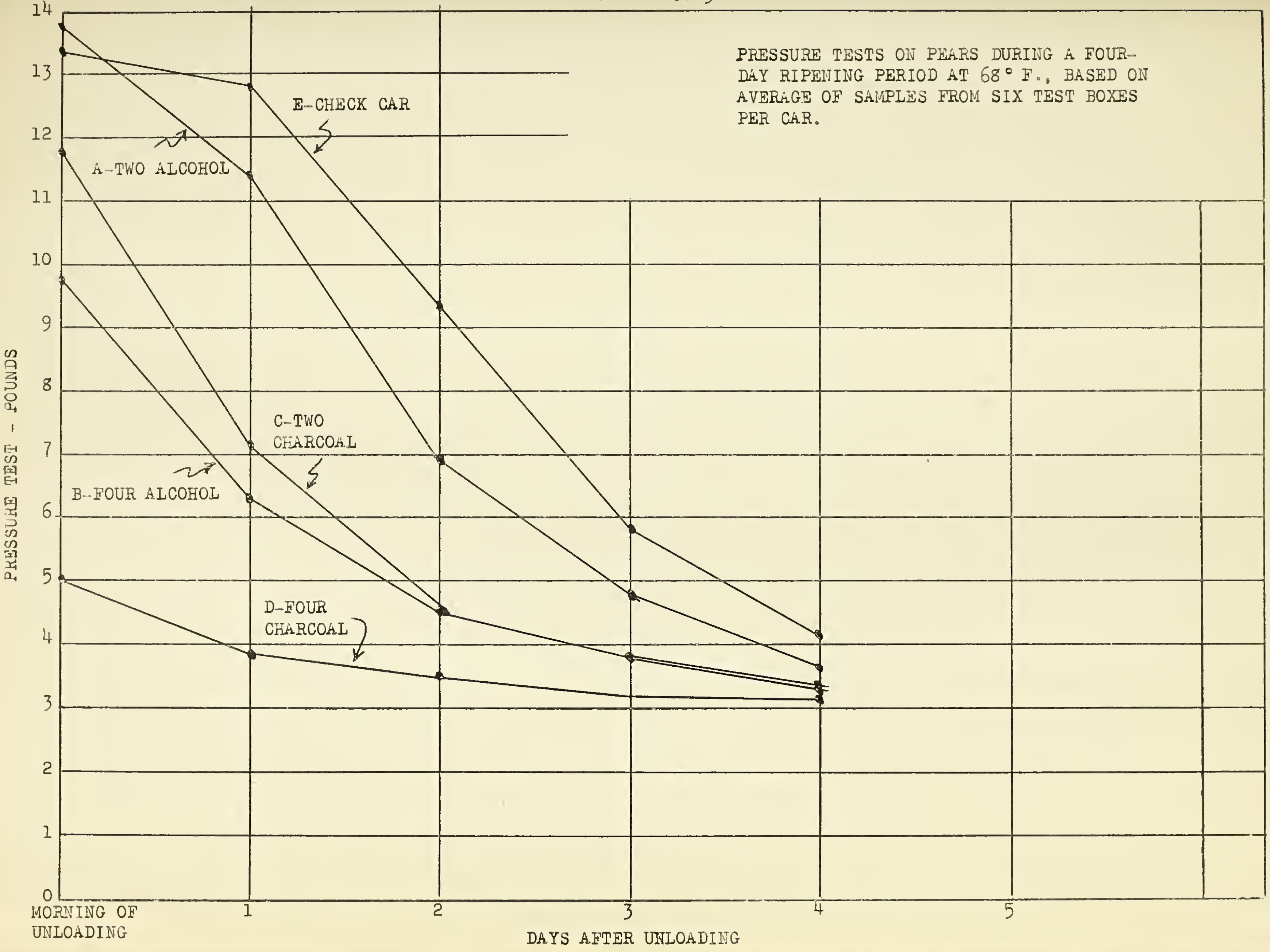


FIGURE No. 3



PRESSURE TESTS ON PEARS DURING A FOUR-DAY RIPENING PERIOD AT 68° F., BASED ON AVERAGE OF SAMPLES FROM SIX TEST BOXES PER CAR.

12- 744 16